Leverhulme Centre for the Study of Value

LCSV WORKING PAPER SERIES NO. 11

Measuring the value of what?

An ethnographic account of the transformation of 'Nature' under the DEFRA biodiversity offsetting metric.

Louise Carver

February 2015
The Leverhulme Centre for the Study of Value
School of Environment, Education and Development
The University of Manchester

The Leverhulme Centre for the Study of Value

The Leverhulme Centre for the Study of Value was founded in 2012 by Professor Sarah Bracking with the generous support of the Leverhulme Trust grant award RP2012-V-041. Sarah Bracking, Patrick Bond, James Igoe, Sian Sullivan and Philip Woodhouse are Co-Investigators of the programme, with Philip Woodhouse the current Director of the Centre, now joined by Research Associates, Aurora Fredriksen and Elisa Greco, and Doctoral students Jonas Amtoft Bruun, Louise Carver, Fortunate Machingura, Rachael Morgan, and Robert Watt. More information about LCSV and our working paper series can be found on our website, **thestudyofvalue.org**

The Leverhulme Trust was established in 1925 under the Will of the first Viscount Leverhulme. It is one of the largest all-subject providers of research funding in the UK, distributing funds of some £60 million every year. For further information about the schemes that the Leverhulme Trust fund visit their website at www.leverhulme.ac.uk/www.twitter.com/LeverhulmeTrust

Published by The Leverhulme Centre for the Study of Value
School of Environment, Education and Development
The University of Manchester
First Floor, Arthur Lewis Building
Oxford Road
Manchester M13 9PL
United Kingdom

http://thestudyofvalue.org

ISBN: 978-0-9932072-0-4

LCSV Working Paper Series

The Leverhulme Centre for the Study of Value (LCSV) Working Paper Series aims to foster the rapid distribution of research findings and work in progress by researchers, post-graduate students and associates of LCSV. The series aims to open up discussions among the global community of scholars, policymakers and practitioners on pressing issues concerning value and valuation practices in social and environmental contexts. All LCSV working papers are available to download free of charge in PDF format via the LCSV website (thestudyofvalue.org/publications) and uploaded at the Social Science Research Network.

The opinions expressed in the papers are solely those of the author/s and should not be attributed to the project funders, LCSV, the University of Manchester or our partner universities. We welcome comments on individual working papers, which should be directed to the author/s directly, or through admin@thestudyofvalue.org.

Contents

List of Tables

List of Figures

Measuring the value of what? An ethnographic account of the transformation of 'Nature' under the DEFRA biodiversity offsetting metric

Louise Carver

Abstract

Biodiversity offsetting and the new 'valuation' discourse from which it emerges, is frequently critiqued as the commodification of biotic life through the entangled logics of capitalism and conservation (Sullivan and Hannis 2012, Yusoff 2011). But what does it actually mean to value nature using biodiversity offsetting and through what specific practices can biodiversity offsetting be called a commodification process? This paper explores the ways in which biodiversity value is performed by the convergence of discourses, institutional networks and the effects of a calculative device (Callon 2007) known as the DEFRA biodiversity metric. Drawing from detailed comparative ethnographic evidence from two sites in the English biodiversity offsetting pilot study that ended in April 2014, this paper charts the iterative layers of value creation whereby biodiversity value is constructed as a new conceptual category, stabilised as a commodity and thereby transformed into a unit of exchange. It demonstrates the ways that biodiversity 'value' is first rendered knowable through nascent ecological quantification techniques and subsequently translated into economic exchange value by way of constructed commensuration between new value entities.

Keywords. biodiversity offset, value, calculative device, commensuration, commodification, DEFRA, metric, ethnography, England

Introduction

> "There are £m-multi opportunities available from markets that protect nature's services. As our understanding of the value of natural capital grows (e.g. UK NEA/TEEB), there is a natural progression to reviewing the scope for new approaches to 'capture' this value. The challenge is to harness these values so they can also become real commercial values. Available estimates point to a significant potential for long-term growth in emerging markets in biodiversity and ecosystem services."
>
> (Presentation slide delivered by David Hill, deputy chairman of Natural England and director of Environment Bank Ltd, 2011[1])

The line of reasoning encapsulated in the above quotation is fast becoming normalised as an approach in conservation and environmental governance in England; namely the use of economic valuation and calculative technologies to 'value' and thus protect and enhance biodiversity and wildlife habitats. Whilst such efforts to ascertain values for non-human nature and natural environments are nothing new, originating from the environmental and ecological economic disciplines, nascent scholarly interest in the modes and methods of such valuation practices are coalescing at the act of valuation itself (c.f. Helgesson and Muniesa 2013). In so far as such valuation practices offer the potential to appease current trends of anthropogenic environmental change and biodiversity loss, biodiversity offsetting has emerged as a politically charged issue and reflects a 'key moment' in the merging of economic and ecological rationales within efforts to build the 'green economy' (Macdonald and Corson 2012, Sullivan 2014). Forming one case study of a broader programme of work within the Leverhulme Centre for the Study of Value, entitled; Human, non-human and environmental value systems; an impossible frontier", this research into new valuation practices for biodiversity conservation investigates the unfolding of pecuniary value frames and practices as part of a broader discourse around 'value' in the name of revitalised efforts for conservation in England. The paper proceeds, in line with the LCSV shared research protocol (c.f. Bracking et al 2014), by investigating how a range of discursive framings, institutional networks and calculative devices, co-act to perform biodiversity offsetting, as a valuation practice, and biodiversity value; as a market good, so that we might better understand how the agenda has emerged and is advancing in England. Drawing from a political ecology lens, the conceptual framework proposes that the active assemblage of these three dimensions afford biodiversity offsetting a certain rationalised potency rendering the logic and development of the policy innovation to be widely taken as inevitable and self-evident.

To help explain this, I also build here upon other political ecology perspectives that have identified a broader, intensifying neoliberal paradigm in conservation and environmental governance, entailing commodification practices otherwise known as "selling nature to save it" (McAfee 1999). And yet, within this tradition of critique it is rarely made explicit which specific commodification processes are referenced and in what ways this capitalist treatment of socio-

[1] http://www.environmentbank.com/files/pesenvironmentalmarketsforbes.pdf (accessed on 6th October 2014).

natural relations is intrinsically problematic (Castree 2005, Castree and Henderson 2014). As such, and in an effort to clarify what it means to create new economic value from nature through the commodification of biodiversity and ecological spaces, this paper settles its focus at the calculative device node of our conceptual framework; the DEFRA biodiversity 'metric', to better understand how nature is transformed under it. In so far as the other components of the framework; the discursive frames and institutional arrangements facilitate the commodity based value production from biodiversity - through its unfurling as a broader political process - it is the transformative, material effects of the valuation metric, as a calculative device, that defines this final act. A political ecology lens offers an analytic vantage point that re-embeds the methodological and technical questions of value calculation and quantification inherent in biodiversity offsetting within a broader political context. By combining the LCSV research protocol with political ecology perspectives I will offer both an empirical and normative contribution to the expanding body of work concerned with theorising new ways of valuing nature.

The structure of this working paper proceeds by setting out the context of the English pilot study on biodiversity offsetting and its relationship to the international context. It henceforth briefly explores the discursive and institutional dimensions of the biodiversity offsetting policy landscape and introduces the DEFRA metric as a calculative device. The next section considers what it actually means to create new economic value from nature through layered processes of commensuration drawing from a Marxian typology of commodification practices and illustrated with examples from primary and secondary data sources followed by a discussion.

The empirical cases drawn upon here form part of my doctoral research undertaking ethnographic work with two DEFRA biodiversity offsetting pilot sites. This research involves following, over a field-work period of 18 months, specific offset cases through the planning system through repeat visits and interviews with a sample of 8- 10 different types of stakeholders involved in each case study or planning application requiring offsets. The sample spectrum includes local government ecologists and planners, developers and their consultant ecologists, private landowners, concerned individuals from wildlife conservation NGOs, local residents and planning commentators from Natural England.

Table 1. DEFRA pilot case study interview codes

	Stakeholder category							
DEFRA pilot site	Local Planning Authority	Private Consultant Ecologist	Natural England	Developer	Planning consultant	Local Resident	Conservation NGO/ Partner	Offset provider
1	LPA1.1	PCE1.1	NE1.1	D1.1	PC1.1	LR1.1	NGO1.1	OP1.1
2	LPA2.1	PCE2.1	NE2.1	D2.1	PC2.1	LR2.1	NGO2.1	OP2.1
3	LPA3.1	PCE3.1	NE3.1	D3.1	PC3.1	LR3.1	NGO3.1	OP3.1
4	LPA4.1	PCE4.1	NE4.1	D4.1	PC4.1	PC4.1	NGO4.1	OP4.1
5	LPA6.1	PCE5.1	NE5.1	D5.1	PC5.1	LR5.1	NGO5.1	OP5.1
6	LPA7.1	PCE6.1	NE6.1	D6.1	PC6.1	LR6.1	NGO6.1	OP6.1
Sequential codes for each category of interviewees e.g. after the first interviewee in each category the codes follow the second decimal point for the second to the ninth								
	LPAx.1-9	PCEx.1-9	NEx.1-9	Dx.1-9	PCx.1-9	LRx.1-9	NGOx.1-9	OPx.1-9

Interviews are supported by secondary public and private domain text data to elucidate the story of biodiversity value(s) and its winners and losers across a range of case studies in England. I will draw attention to the fact that this empirical work forms the basis of ongoing research and therefore offers some preliminary conclusions since biodiversity offsetting in England is a live and dynamic policy that is unfolding in real time. Due to the sensitive, political, and presently experimental nature of biodiversity offsetting in England, and concerns of those involved with publically 'getting it right', all respondents and offsetting cases have been anonymised.

Biodiversity offsetting: the English Pilot Study

Biodiversity offsetting is a relatively new policy apparatus in the global conservation tool kit and describes a process whereby the ecological harm at a development site can be offset by a biodiversity gain elsewhere. The act of 'offsetting' is found in the final stage of the mitigation hierarchy used to evaluate and govern the ecological impacts of construction and infrastructure development. It proposes to take steps to avoid, then mitigate (minimise) harm through landscape design and construction practices and in the last instance to compensate for residual ecological impacts in line with a last resort framework [2](NPPF 2012: 27). In England, a series of high level policy papers laid the groundwork for biodiversity offsetting to surface as a policy option (see Sullivan and Hannis 2014 for discussion), and it emerged as a national scale pilot study that operated between April 2012 and April 2014, following the recommendations from

[2] Paragraph 118 of the NPPF stipulates: "When determining planning applications, local planning authorities should aim to conserve and enhance biodiversity by applying the following principles: "if significant harm resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused;"

the Government's first natural environment White Paper for 20 years, 'The Natural Choice; Securing the Value of Nature'.

DEFRA defines biodiversity offsetting as "conservation activities designed to deliver biodiversity benefits in compensation for losses, in a measurable way." (DEFRA, 2011b: 1). Offsetting is proposed, therefore, as a unique way to ameliorate or mitigate the gradual attrition of varying scales of biodiverse habitats through the national planning process, which until now has systematically failed to prevent widespread ecological deterioration through land use change, construction and the expansion of the built environment. The UK National Ecosystem Assessment (2011: 05) reported that 30% of the nation's ecosystems are declining and many others are in a degraded state. The RSPB (2013: 6) goes further in reporting that 60% of UK species are declining, of which 31% are in strong decline. The Lawton Review (2010), an independent review of England's wildlife sites and ecological network, chaired by Professor John Lawton, puts forward, as the principal cause of the deterioration in ecosystems and species; land use changes leading to the loss and fragmentation of wildlife habitats across the country. The priority, it argues, is therefore principally spatial, involving the need to restore a coherent and resilient ecological network as a matter of urgency. The call can otherwise be articulated as "more, bigger, and better joined" space for nature, and carries with it an estimated cost to be between £600m and £1 billion annually (Lawton et al 2010), underlining the rationale that novel sources of finance for conservation priorities must be developed (cf. Roth and Dressler 2012).

In April 2012, DEFRA issued an expression of interest for local planning authorities to run voluntary pilot schemes for biodiversity offsetting. It subsequently selected six local authorities and their associated local planning authorities (LPAs) to carry the pilot study forward. These were Doncaster, Essex, Warwickshire, Coventry & Solihull, Devon, Nottinghamshire and Greater Norwich. In addition to the local authority participants, a selection of complementary partners from a range of industries and sectors are central to the pilot scheme. The nine complementary pilot partners comprise two construction companies, one extractive industry, three ecological consulting firms, two local governments and a local wildlife trust. In addition, Thameslink Programme, presently the largest rail infrastructure project in the country, and which is voluntarily offsetting its ecological impacts was named a DEFRA demonstration project in September 2013. Table 2 outlines the pilot scheme participants.

Table 2. DEFRA biodiversity offsetting pilot participants

DEFRA biodiversity offsetting pilot projects		
Local authorities	Devon of which there are three sub-pilots	Exeter and East Devon Growth Point
		South Devon
		North Devon UNESCO Biosphere Reserve
	Doncaster	
	Essex	
	Greater Norwich	
	Nottinghamshire	
	Warwickshire, Coventry and Solihull	
Complementary pilot participants	Atkins	Construction
	Aggregate Industries	Mineral extraction
	Balfour Beatty	Construction
	Eco Bos & Code 7 Consulting	Professional ecological consultancy
	Golder Associates	Mineral extraction
	Somerset Biodiversity Partnership	Range of local authorities, private organisations and conservation agencies
	Worcestershire County Council	Local authority
DEFRA demonstration projects	Thameslink Programme	Rail infrastructure, south-east of England and London

In local authority pilot study areas, LPAs have been offering developers the option of meeting their biodiversity compensation requirements from planning policy through offsetting. However, the initiative has remained voluntary, meaning that if developers preferred to use existing processes to deliver the compensation through various conditions and compensation obligations set out in the Section 106 agreements, they have been able to do so. Recommendations from the Government Environmental Audit Committee inquiry into biodiversity offsetting propose that the policy would need to be mandatory to generate the critical mass of participation required for a market to take shape. (EAC 2013)

Consensus around specific policy details such as the temporal and geographic thresholds of offsets, standardised biodiversity impact assessments and pricing methodologies has remained elusive, and participants have exercised relative autonomy in designing their localised systems, with many still experimenting and iteratively adapting the methodologies. Furthermore the pilot study local authorities have experienced varying degrees of development and progress in the

two-year period in which they were underway due in large part to a combination of local context factors principally associated with professional capacity within the planning departments themselves in the context of pressing workloads and budget cuts to local government (LPA2.1, LPA6.1, LPA3.1, NGO5.1). Another important reason why few have managed to secure offsets is due to the specific order in which planning decisions need to be made, with many finding that by the time offsetting became a possibility in the process it was already too late for other reasons. These may relate for example to a developer's viability assessments that have not factored in the full cost of compensation payments for biodiversity loss which are a larger financial sum than would have otherwise been agreed in the absence of offsetting (LPA1.1, LPA5.1). DEFRA, meanwhile, conducted a public consultation in September 2013, following the publication of its Biodiversity Offsetting Green Paper to solicit views and expertise from the public and professional sectors (DEFRA 2013). Shortly after, the Environmental Audit Committee conducted a Parliamentary Inquiry into the policy in October 2013 (c.f Sullivan and Hannis 2014). At the time of writing this working paper, we are waiting to hear an announcement from DEFRA about what role biodiversity offsetting will have in England going into the future, following the pilot study evaluation evidence that Collingwood Consultants collected and presented to DEFRA in the Summer of 2014.

However, despite the pilot officially ending in April 2014, local authorities that have dedicated significant time and energy to introducing offsetting are pressing on with their efforts, yet its legislative future in England is uncertain. The government are showing reticence towards institutionalising compulsory offsetting in planning law, in part because there is no evidence yet put forward that supports the idea it will offer any cost savings to planning processes, which constituted one of the central tenets of the proposal (personal communication with DEFRA). Despite wavering political will in England, there are different structures in which biodiversity offsetting can move forward, for example through voluntary markets rather than compliance, or by the designations of local planning authorities where they feel that offsetting assists their efforts in observing the NPPF policy guidelines for 'no net loss[3]. At the EU level, a 'No Net Loss' initiative is part of the European Biodiversity Strategy to 2020 and includes biodiversity offsetting as a policy mechanism to achieve this. The EU No Net Loss public consultation closed on October 2014, and depending on how the EU carries forward this agenda, even if biodiversity offsetting is not instigated in planning policy in England, it may still continue to have a presence in EU biodiversity policy.

The introduction of a biodiversity mechanism into planning processes in England represents a potentially profound transformation to the way the national planning process operates. Thus the focus of this early working paper centres on the experiences of local government planning and ecology departments, rather than on the complementary pilot study participants. For the latter, experimenting with biodiversity offsetting remains to a large degree a theoretical exercise

[3] The NPPF (2012: 3), in referencing DEFRA's natural environment white paper (DEFRA 2011), stipulates that amongst other principals, "Pursuing sustainable development involves seeking positive improvements in the quality of the built, natural and historic environment, as well as in people's quality of life, including (but not limited to): - moving from a net loss of bio-diversity to achieving net gains for nature."

explored retrospectively through existing developments rather than on current cases contingent on English planning legislation, planning permission and biodiversity policy and statutory obligations. However, to begin with I will consider the conceptual framework and its utility in understanding the emergence of biodiversity offsetting in England.

The LCSV conceptual framework

The conceptual framework guiding this research tracks the constitutive assemblage of discursive strategies and ideological frames, the institutional networks and the calculative devices that collectively interact to produce new value and value entities within DEFRA's biodiversity offsetting trials. 'Value entities' refer here to things which have undergone and been subjected to particular kinds of calculation practices and that have been transformed into new modes of value in the process. This section lays out the three component parts of the conceptual framework. It starts with a discourse analysis of the knowledge production and validation work that en-frames nature in 'value' terms. Secondly it plots the strategic alliances amid institutional clusters (and the individual actors within) that form active assemblages of relative power and agency. Lastly, it applies critical analysis to the calculative technologies and devices, namely the biodiversity metric and metrological approaches to assigning quantitative and ultimately economic value to biodiversity, such that it may be produced and circulated as a newly valued market entity. Collectively these three nodes to the research protocol form the foundation for investigating the production of value in biodiversity offsetting, and the particular ways in which the metric conceptually transforms biodiversity for exchange value via commodification processes of abstraction and individuation.

1. Discursive and ideological frames

Presently in England, biodiversity offsetting and its discursive origins in 'valuing' and, more specifically , '*economically* valuing' nature can arguably be traced back to decisive epistemic shifts in environmental governance over recent years, manifest in particular within the outcomes from and commitments made at the 10th Conference of Parties to the Convention for Biological Diversity (CBD) in Nagoya, 2010 and the publication in the same year of the influential report The Economics of Ecosystems and Biodiversity (TEEB).

While the institutional synergies and overlaps between business and conservation have been developing for decades (MacDonald 2010, Büscher et al. 2012 Brockington and Duffy 2010), TEEB, with its overt narrative for realising the "economic invisibility of nature" and illuminating its "true" value, constituted a crucial shift that laid the discursive foundations at a global scale. TEEB presents an overarching heuristic of valuation practices around a paradigm shift in conservation, namely that the "value" of nature must first be "recognised", then "demonstrated" and finally "captured" (TEEB 2010: 13). The 2010 CBD, and parallel publication of TEEB is otherwise known as a key moment at which a critical mass of support

within business, finance, policy and conservation sectors was mobilized around this new rhetoric for conservation (MacDonald 2012). As such, TEEB, displays its power over the global conservation discourse (Fairclough 2012), through penetrating the outcomes from Nagoya and subsequently preceding uptake in various national policy positions and scientific contexts such as 2010 DEFRA White Paper: 'The Natural Choice: Securing the Value of Nature'; the DEFRA 2011 'Biodiversity 2020: a strategy for England's ecosystem services and wildlife' and the 2011 'National Ecosystem Assessment'. Identifying the central narratives running through these documents illustrates the progression, through layered framings, of the reasoning and rhetoric around 'valuing nature' giving rise to the particular policy configurations and the common sense approach of quantifying and trading ecological value, such as 'natural capital' through biodiversity offsetting.

Originating from these documents are five pronounced discourses, laid out in sequence to clarify the rationale that each subsequent 'value' discourse builds from the prior. There are important differences, for example between the first and foundational narrative of the need to "value nature properly" (DEFRA 2010: 3) with its ambiguous but normative overtones and the second, for which the first is a precondition – that is 'valuing nature economically'. The slippage between the two value frames, in so far as they are projected as interchangeable and synonymous, can be arguably linked to the structural way that the causal logic operates between the former and its iterative follower. The first treats ecological decline as a result of a deficit of valuation, a process otherwise known as "market failure" (Yusoff 2011), while the second attempts to rectify this by applying a corrective calculative device to price in the externality. However, 'pricing in' may also act as a logic that further structures and narrows any possible alternative interpretations of such value (*ibid.*). It follows that the representation of biodiversity as ecosystem service provider, whose processes can be weighed in equivalence against other such processes further prepares it for an exchange, in specific but decisive ways. I will explore these in more depth below in considering the biodiversity metric. These key narratives animate the rhetorical progression underpinning the reasoning behind valuing and thus ultimately compensating negative value through biodiversity offsetting.

Valuing nature

Employing 'value' to invigorate new approaches to biodiversity conservation forms the primary narrative from which the others stem. It indicates a general principal that acts as a holistic framing for the many varied notions of value. Tellingly it is afforded center stage by constituting the title of the first UK Natural Environment White Paper for 20 years, 'The Natural Choice: securing the value of nature' (2010).

Valuing nature economically

Value, in a general sense is treated as broadly synonymous and often interchangeably with economic value. Assisting this subtle shift, is the growing appearance of economic metaphors to express ecological value such as 'natural capital' and 'natural dividends'

The 'green' economy

'Green' economy discourses are supported and underpinned by the prior two discourses, such that they pivot on the idea that valuing 'ecosystem services' will allow the market economy to 'capture' this value to *protect* nature whilst simultaneously opening up economic growth opportunities.

Cost-benefit accounting and achieving a 'net gain' in nature

In parallel to a discourse on economic valuation is the narrative of cost-benefit decision-making and comparable valuation techniques, facilitated by idea of equivalences. In so far as cost-benefit analyses derive from an abstracted sense of reality and quantified models of nature, they dovetail with the other key narrative of biodiversity offsets - that of achieving targeted "net gains" (Lohmann 2009). Conceptions of nature that are materially commensurable and non-specific are significant for and conducive towards the idea that environmental harm can be unproblematically 'offset' somewhere else.

A new global vision and direction for biodiversity policies, institutional reforms and methodological approaches

Discourses around novel approaches, paradigm shifts and institutional reforms have been invigorated by responses to new insights, data and analyses on the economic values, market and opportunity costs of degrading ecosystems and environmental decline, expressed through the TEEB report, shaped by the commitments made at Nagoya in 2010 and articulated in the UK National Ecosystem Assessment of 2011.

The discursive frames briefly introduced here are, by and large, the outcomes of higher-level and originating discursive shifts over the past 15 years in environmental governance on assigning an economic worth to ecosystems and their services (cf. Constanza et al 1997). As such the overarching and foundational discourses relate to the re-conceptualisation of nature as 'ecosystem services'. Lifting from the Millennium Ecosystem Assessment, TEEB outlines the four overall categories of ecosystem services as supporting, regulating, provisioning and cultural[4]. The re-framing of nature as 'ecosystem service' therefore is crucial to the 'value'

[4] Provision ecosystem services describe the *material* outputs such as food, water and other natural resources. Regulating ecosystems services function as *regulators* such as air and water quality or carbon sequestration. Habitat or supporting ecosystem services underpin all others in that they provide living spaces for biodiversity and wildlife. Cultural ecosystem services include the non-material benefits that people obtain from contact with nature and landscapes

discourse since it illuminates and emphasises multiple *use values* of nature, but also includes those that fall out of, or conflict with, traditional market indices of value such as aesthetic and spiritual values. Yet, such a turn arguably remains deficient in adequately representing these non-market values. For example, Sullivan (2010) discusses the "ideational transformation" of nature by way of ecosystem services as "commodity fictions". These act, paradoxically, to further distance nature from culture through linguistically framing it into relations of utility and exchange, despite the seemingly progressive rhetoric around greater valuations of nature (*ibid.)*. Thus, while the majority of the policy discourse engages in the technical aspects of what a functioning biodiversity policy would look like, Sullivan and Hannis (2014), writing as part of this LCSV working paper series, propose a more deliberative debate reflecting on the ways in which discursive actors differently understand and conceptualise both the value of nature and the nature of value and the subsequent appropriateness of extending market based mechanisms in efforts to reverse environmental destruction (see Sullivan and Hannis 2014 for a more detailed discussion of competing perspectives and discourses about biodiversity offsetting).

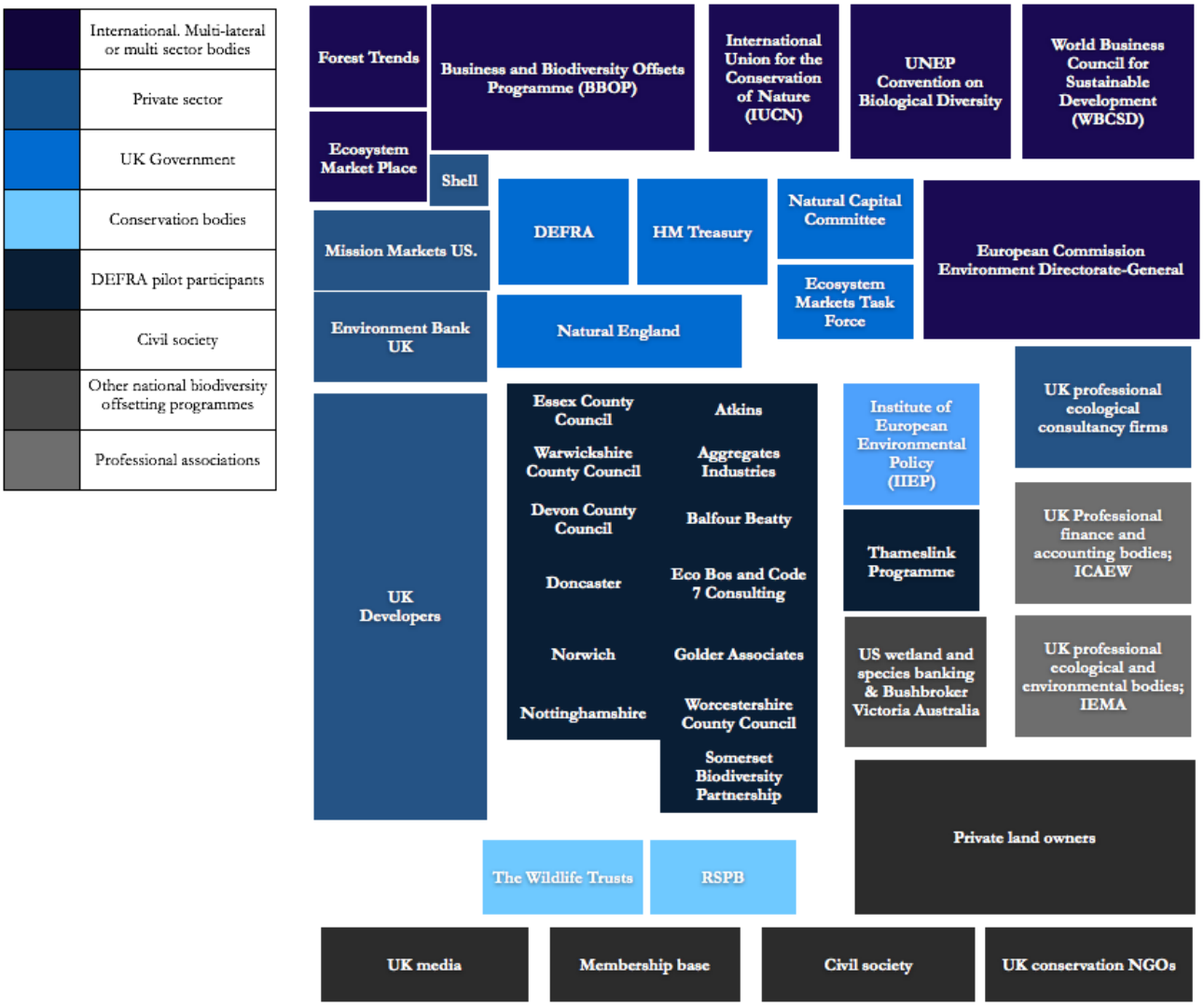
The frames and discourses presented above are central to the processes of value creation in biodiversity offsetting in the way that they normalise certain world-views or conceptualisations of both nature and value. An international assemblage of institutions and expert actors are active agents in the production, reproduction and contestation of these rationales and discursive strategies. The aim is to identify and illuminate the key moments, interventions and convergences in which these discourses are brought to life and carry forth with "world making" capacities (Igoe 2010, Tsing, 2000). It is towards institutional assemblages and organizational clusters, as the second node of the research protocol that the conceptual framework now turns.

2. Institutional assemblages and networks

Underlying the English biodiversity offsetting study there is a notable strategic network of alliances from local to global scales that deserves attention. Here I aim to tease out the arrangement of actors, and explore some specific examples of key individuals and institutions that play active and important roles within the biodiversity offsetting landscape. Figure 1 illustrates the actors and organisations that either through direct involvement in the pilot scheme or more distant associations constitute a surface view of the English biodiversity offsetting policy landscape.

including aesthetic, spiritual or psychological benefits (MEA 2000).

Figure 1. Institutional networks associated with English biodiversity offsetting



While, it is tempting to think of international institutional assemblages along bounded, hierarchical strata, this spatial metaphor is easily disrupted by organisations and networks as well as key individuals that sit at multiple scales and levels of authority and navigate between. Kerry ten Kate, for example as well as directing the international multi-institutional platform, BBOP (Business and Biodiversity Offset Programme), co- authored both the DEFRA and the EU biodiversity offsetting scoping reports, sits as one of eight members on the UK Natural Capital Committee and acts as an external expert to the UK Ecosystems Market Task Force. This is also true of David Hill, contributor to DEFRA's scoping study report and former deputy chairman of the Government's environmental advisory body Natural England at the time the pilot study was formulated. Hill is also, significantly, the director of the Environment Bank Ltd, a commercial company positioning as broker to and online market place for UK biodiversity offsets, and has been a high-level advocate for establishing the system in England, to which the quotation at the beginning of this paper attests. The place of the Environment Bank within the offsetting pilot study has understandably been perceived as a significant conflict of interest since Natural England, as a government advisory body, devised and

maintains responsibility over the scheme's key technology; the biodiversity metric, in addition to providing quality assurance and advisory services on the development of the pilot to the local authority participants.

The institutional networks outlined above are not only formal and bounded organisational establishments or formal policy spaces, but occupy moments of convergence and confrontation over time and are realised at national and international events as well as over digital networks, webinars and social media. In June 2014, DEFRA along with the Zoological Society of London (ZSL), and BBOP co-hosted the first international Forum on biodiversity offsetting at London Zoo; To No Net Loss and Beyond, whereby 250 delegates from a range of extractive, infrastructure and energy firms, ecological and sustainability consultancies, financial institutions, research and scientific organisations as well as conservation NGOs, government departments, and international bodies came together for the first time to discuss the methodological and technical minutia of biodiversity offsetting, over two days of extensive networking, alliance building and knowledge sharing. However, both within and beyond the No Net Loss Forum, a significant push-back or counter narrative was gaining traction amid a consortium of international NGOS, civil society groups and campaign organisations that operate under the slogan 'Forum for Natural Commons: nature is not for sale'. The counter forum, held the day before the DEFRA/ BBOP event, was attended by close to 100 people from academia, civil society groups, the media and the interested general public illustrating just how starkly the direct contestations and struggles are playing out over the development of narratives and frames in the proposals for introducing biodiversity offsets in English, EU and international planning law (c.f. Carver, forthcoming for a discussion of the competing justification discourses).

In addition, the UK media play a vital constitutive role in the assemblage of actors and alliances, in reporting specific controversies of proposed planning developments under way in the pilot, and in commenting on key announcements by Government. The media catalyse public debate about biodiversity offsetting and the important transformations it presents for planning and conservation policy which is significant for subsequently influencing public opinion among the membership bases of civil society members based organisations like the Wildlife Trusts and conservation NGOs like the RSPB. The Wildlife Trusts and RSPB are positioned as the most appropriate and desirable offset conservation providers by local government and industry as experienced and established conservation agencies, yet with angry or upset members following contemptuous opinion pieces, such as George Monbiot's account the "spirit of destruction" built into the principal of biodiversity offsets[5], their participation in offsetting has so far been one of prudence. Questions also open up around the changing funding streams for conservation work, where offset money generated from biodiversity destruction elsewhere has been dubbed as a toxic source of funding by financially tying local governments and nature conservation NGOs directly to developers such that they are

[5] http://www.theguardian.com/environment/georgemonbiot/2012/dec/07/biodiversity-offsetting-unleash-wildlife-destruction (accessed on 6th October 2014)

compromised in their capacity speak out about what kind of development happens and where[6].

As such, the discursive framings are produced, circulated and reproduced at different scales and by a variety of actors in some way connected in the pilot scheme, and who therefore play active roles in both bringing it into being and shaping its ongoing development. The final layer of the conceptual frame traces not just social action and intervention but questions of materiality through exploring the agency and effects that metrological and calculative technologies have in the production of new exchange value in non-human natures. Anderson and Macfarlane (2011: 126) speak of agency's "ontological diversity" surmising that it is not only humans and institutions that affect the character of social and ecological change but non-human elements; or 'actants'. Murray Li (2007 citing Foucault 1980: 194) articulates the agency of assemblages as forming out of highly heterogenous elements which include a range of "discourses, institutions, architectural forms, regulatory decisions, laws, administrative measures, scientific statements, philosophical, moral and philanthropic propositions". It is with this in mind that we turn to the third node of the conceptual protocol - to explore the calculative device at play.

3. The biodiversity metric; a calculative device

The LCSV shared research protocol investigates "calculative devices" (Callon 2007) as new techniques and tools of quantification that are used to influence social outcomes by public and private actors. These calculative devices, such as equations, formulas or score-cards, or in this case the DEFRA biodiversity metric, shape and condition the valuation process of any particular 'calculative technology', for example within biodiversity offsetting (Bracking et al., 2014). The power of the calculative device is that it produces new calculated entities, which can be counted, and accounted for, costed and circulated as new commodities.

The DEFRA metric was developed by Natural England in consultation with a range of external consultants and advisors (cf. Treweek et al 2009, 2010, ten Kate et al 2004) and adapted from the habitat hectares approach first developed in New South Wales, Australia in its Bushbroker scheme (NE1.1). It quantitatively aligns the qualities of a habitat's ecological distinctiveness against its condition in a matrix that produces the quantitative value of a hectare of biodiversity habitat as a numerical surrogate. Distinctiveness includes parameters such as species richness, diversity, rarity (at local, regional, national and international scales) and the degree to which a habitat supports species rarely found elsewhere (Treweek et al. 2010). DEFRA (2012) guidance for measuring habitat condition is to use the Farm Environmental Plan manual for the Higher Level Stewardship Scheme (Natural England 2010) which is designed to give a specific output categorising habitats into three states, namely "favourable, favourable recovering, and unfavourable". The matrix variables along habitat distinctiveness and habitat condition delineate three graded bands. Distinctiveness follows numerical proxies of 2, 4 or 6 units to designate low, medium and high distinctive value. Habitat condition is organized according to

[6] Ariel Brunner, Head of EU Policy, Birdlife Europe speaking at the debate 'Agree to Disagree' at the DEFRA/BBOP/ ZSL No Net Loss Conference 2014.

poor, moderate and good and signified by 1, 2, and 3, unit numbers respectfully (cf. DEFRA Metric Technical Paper 2012). The processing of ecological data through this matrix supplies a simplified, quantifiable picture of a single hectare of biodiversity habitat's ecological worth, ranging from a credit value between 2 and 18 units. The number of hectares under planning proposal may then be multiplied by the value of a single hectare of habitat to produce the final number of credits subject to loss and/or necessarily offset. Table 2 encapsulates the calculative device in outlining the metric value table.

Table 2. The DEFRA biodiversity metric

Matrix showing distinctiveness and condition		Habitat Distinctiveness		
		Low (2)	Medium (4)	High (6)
Condition	Good (3)	**6**	**12**	**18**
	Moderate (2)	**4**	**8**	**12**
	Poor (1)	**2**	**4**	**6**

Source: DEFRA 2011

Inherent in the management and governance of enacting a biodiversity offset are myriad risks and uncertainties, which are associated with the difficulty of 1) achieving an ecologically meaningful offset; 2) the time lag between biodiversity loss and the creation of its corollary offset; and 3) the geographical distance between the loss and offset site and the strategic placement of the latter in meeting local biodiversity policy priorities. The DEFRA offset model attempts to account for these risks technically and numerically with multiplier metrics that calculate the augmentation or enlargement requirements of the offset provision (and therefore the resulting price to the developer through compensation) depending on the risks of the offset a) not working; b) creating a temporary 'net loss'; and c) falling outside of the strategic geographic boundary or somewhere ecologically less-optimal (DEFRA 2013, 2012).

However, evidence from the ethnographic fieldwork with offsetting pilot sites has shown that the business of making the DEFRA metric applicable to real life planning cases has been a good deal more complex than originally anticipate and has proven to be a process of constant iteration, trial and error. At the time of writing one site was embarking on version eighteen of its assessment formula in an effort to find the right balance between ecological integrity, economic palatability and policy pragmatism. Changes to the assessment calculator in this case have included, amongst other things, additional category values of 1, 3 and 5 for local habitat types that have greater regional than national distinctiveness and rarity (the guidance values at set at the national level by DEFRA), as well as extensive formatting changes and editions to make the calculator more "user-friendly" and manageable (LPA5.2). Modification decisions taken about the local level category values (for example, concerning what value scattered trees

should have) are made within the wider knowledge of the resultant numerical and financial outcomes, through their multiplication or division effects on biodiversity loss (Habitat Impact Score) or onsite mitigation (Habitat Mitigation Score), and thus their function to either prohibit or facilitate, via final compensation costs, development planning applications.

The metric, as a valuation practice and device is further explored in the following section, which critically theorises how it is that new value and value entities are produced through biodiversity offsetting. In following the three nodes of the research protocol, we are drawing upon the performative tradition in economic sociology (Callon 2006), which focuses not on the idea of an external *a priori* existence of an 'economic x', but instead on how it is that the economic is made; on how it is performed in processes of 'economization' and 'marketization'. This is the central question concerning how new valued entities come into being and is addressed in the following section.

Value creation in biodiversity offsetting

As a live and rapidly evolving policy field, biodiversity offsetting represents a decisive and significant transformation in the governance and logics of conservation. Underlying this shift are the particular ways in which nature is 'valued', and the modes in which this value is made visible and importantly, exchangeable. This section considers what it actually means to locate new value in nature - using biodiversity offsetting in particular. It proceeds by laying out the iterative layers of value creation underlying the transformative process in which biodiversity value is first constructed as a new conceptual category, stabilised as a commodity and thereby 'made' into a unit of exchange. In other words it considers the processes through which biodiversity offsetting enacts the commodification of nature as a way of producing and then realising this new value in the economic sphere or market capitalist sphere.

The production of new value derives principally from two general processes constructing notional commensurability between biotic entities, first, by re-codifying ecological information into numerical scores and second by assigning these scores an economic price. Here I follow Castree's (2003) typological review of commodification processes, and draw from Thomas (1992: 28) who proposes that "the commodity status of a thing is not intrinsic, it is assigned". Castree suggests, "…the question then is not what is a commodity but what kind of characteristics do things take on when they become commodities?" Following Castree, we can see how it is that biodiversity as a general category (and its constitutive animate components) is ontologically altered to operate as a commodity for market exchanges. It is, *vis a vis* this mutation that biodiversity attains new value in a market sphere and is rendered active in economic rationalities of decision making. This paper consequently illustrates, with the use of primary and secondary case studies from the live English pilot scheme how these transformative, commodification processes operate and function through the calculative technologies of biodiversity offsetting.

Biodiversity offsetting; commensuration and commodification

What then, qualifies biodiversity offsetting specifically, as a form of commodification? In his typological review of Marxist definitions of commodification practices Castree (2003: 278) argues, that at the most abstract level capitalist commodification is:

> "[…] a process that ensures qualitatively distinct things are rendered equivalent and sellable through the medium of money. Particular commodity-bodies (use values) are thus commensurated and take on the general quality of exchange value" (Castree, 2003: 278)

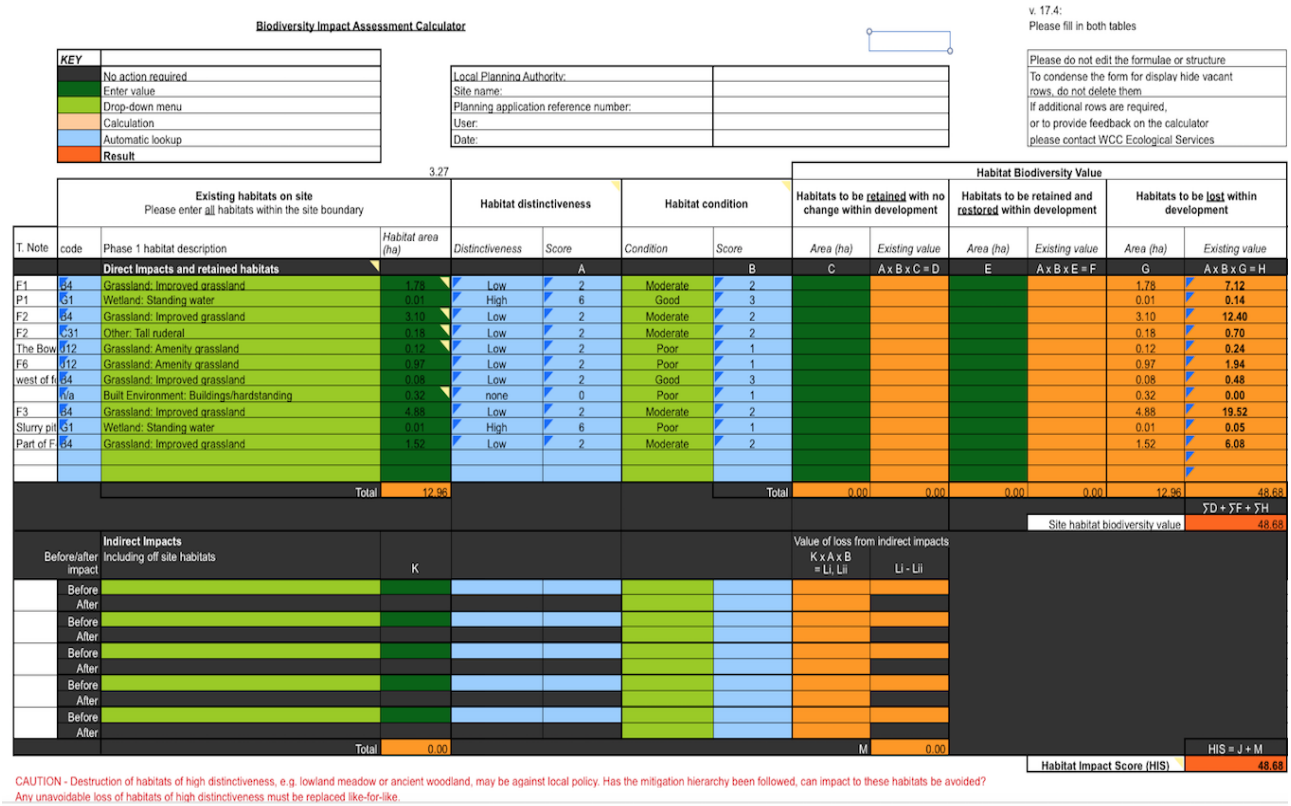
Thus, it is the particular acts engaged in rendering 'biodiversity' commensurable with other nature, and ultimately with pecuniary value, that underpins the commodification process, and as such it is these that shape the production of new value within biodiversity offsetting. Castree's (*ibid.*) typology outlines the practices of individuation, abstraction, privatisation, alienation and displacement as central to the commodification stages of nature. The present analysis considers the processes of individuation and abstraction in more depth, since these operate most prominently as a function of the metric. Questions of privatisation, alienation and displacement appear more loosely in connection with the offset value process but do not form central interests at this stage due largely to the limitation of space. The significant features of individuation and abstraction processes are that they construct notions of equivalence to produce exchange value and operate as sub-processes underpinning the *two* principal stages of commensuration that occur within biodiversity offsetting value production, of quantification and monetisation. Before turning to abstraction and individuation, let us briefly re-cap, in more detail on these two *general* layers; of constructing numerical score cards and designing pricing methods around those numbers.

Stage 1. Translating nature into numbers

The first stage of the process in constructing the biodiversity unit value constitutes the translation of nature, and knowledge about nature, namely formal ecological information into a medium that makes it commensurable with other, quite distinct things. Numbers form proxies for qualitative characteristics and are calculated with the aid of the DEFRA biodiversity metric. As described in Section 1, the metric supplies the 'category values' for the two variables- habitat condition and distinctiveness, and can be calculated through inputting the data into a formula on an Excel sheet. Figure 2 shows for illustrative purposes the Biodiversity Impact Assessment Excel calculator that LPAs may use to make their calculations. There are separate calculative processes for each actor or stage of the offsetting process; the developer, offset provider, the summary formula (comparing baseline conditions of both sites, loss at the development site and target condition at the offset site) and finally the key to be used for the multiplier values used to reflect the difficulty of recreating different types of habitat to account for the risks involved in habitat creation not working. Multipliers numerically inflate the total unit value that is required to compensate for a loss, which would then be reflected in the costs to a developer. Much like the distinctiveness and condition scores, the difficulty multipliers are banded into three categories of low, medium and high difficulty, with values of 1, 1.5 and 2 respectively. By

way of example, a broadleaf woodland plantation that is deemed to be of medium difficulty to create is thus awarded a multiplier score of 1.5. Putting aside the time it would take to reach target condition and mature (of more than 32 years), this principal operates by assuming that in creating an extra 50% of habitat (through a 1.5 multiplier), even if one third of the total offset provision failed, over the 32 years expected to target condition there would be 'no net loss' of biodiversity.

Figure 2. Biodiversity Impact Assessment example calculator



Biodiversity Impact Assessment Calculator

v. 17.4:
Please fill in both tables

KEY	
	No action required
	Enter value
	Drop-down menu
	Calculation
	Automatic lookup
	Result

Local Planning Authority:	
Site name:	
Planning application reference number:	
User:	
Date:	

Please do not edit the formulae or structure
To condense the form for display hide vacant rows, do not delete them
If additional rows are required, or to provide feedback on the calculator please contact WCC Ecological Services

3.27

		Existing habitats on site Please enter all habitats within the site boundary		Habitat distinctiveness		Habitat condition		Habitat Biodiversity Value Habitats to be retained with no change within development		Habitats to be retained and restored within development		Habitats to be lost within development	
T. Note	code	Phase 1 habitat description	Habitat area (ha)	Distinctiveness	Score	Condition	Score	Area (ha)	Existing value	Area (ha)	Existing value	Area (ha)	Existing value
		Direct Impacts and retained habitats			A		B	C	A x B x C = D	E	A x B x E = F	G	A x B x G = H
F1	B4	Grassland: Improved grassland	1.78	Low	2	Moderate	2					1.78	7.12
P1	G1	Wetland: Standing water	0.01	High	6	Good	3					0.01	0.14
F2	B4	Grassland: Improved grassland	3.10	Low	2	Moderate	2					3.10	12.40
F2	C31	Other: Tall ruderal	0.18	Low	2	Moderate	2					0.18	0.70
The Bow	B12	Grassland: Amenity grassland	0.12	Low	2	Poor	1					0.12	0.24
F6	B12	Grassland: Amenity grassland	0.97	Low	2	Poor	1					0.97	1.94
west of f	B4	Grassland: Improved grassland	0.08	Low	2	Good	3					0.08	0.48
	n/a	Built Environment: Buildings/hardstanding	0.32	none	0	Poor	1					0.32	0.00
F3	B4	Grassland: Improved grassland	4.88	Low	2	Moderate	2					4.88	19.52
Slurry pit	G1	Wetland: Standing water	0.01	High	6	Poor	1					0.01	0.05
Part of F	B4	Grassland: Improved grassland	1.52	Low	2	Moderate	2					1.52	6.08
		Total	12.96				Total	0.00	0.00	0.00	0.00	12.96	48.68
													∑D + ∑F + ∑H
												Site habitat biodiversity value	48.68

Before/after impact	Indirect Impacts Including off site habitats	K	Value of loss from indirect impacts K x A x B = Li, Lii	Li - Lii
Before				
After				
Before				
After				
Before				
After				
Before				
After				
Before				
After				
	Total	0.00	M	0.00
				HIS = J + M
			Habitat Impact Score (HIS)	48.68

CAUTION - Destruction of habitats of high distinctiveness, e.g. lowland meadow or ancient woodland, may be against local policy. Has the mitigation hierarchy been followed, can impact to these habitats be avoided?
Any unavoidable loss of habitats of high distinctiveness must be replaced like-for-like.

The different graded bands provided for habitat distinctiveness and condition, when multiplied, produce the credit value per single hectare. Importantly, this metric, and its relationship to the *qualitative* disaggregated ecological information it represents, defines what is distinctive and desirable about biodiversity offsetting, in its deviation from the traditionally negotiated compensation processes through Section 106 agreements, as a specific way of 'valuing nature' and obtaining recompense for ecological loss through the English planning system. Unlike the subjective negotiation for compensation payments that typifies existing planning processes, biodiversity offsetting, it is argued, provides a uniform methodology for measuring and demonstrating the value of a habitat, according to pre-defined, standardised value bands along a continuous numerical continuum. The appeal of the metric then is that it is proposed to circumnavigate a case-by-case negotiation and tussle between planners, developers and professional ecological consultants over what exact compensation is required and how much it should cost the developer. These differences are discussed by a senior ecologist from Natural England:

> "I think under the old way of doing things the outcomes for biodiversity all came down to who was sat around the table and how well they negotiated and it wasn't transparent as to what mechanism people had gone through to come up with the outcome that they did. Whereas, under this system, which is a very simple system- and whether people like it or not, it says "here we are, we have come up with a figure which is effectively a proxy for biodiversity on site A"- which is being impacted and we will expect someone at some other site, to put back biodiversity that equals this measure. That's our measure between the two places and it's transparent and you can see how it's done." (NE1.1)

This reduction, across divergent objects to one fluid unit continuum makes the idea of net gains and losses coherent. The appeal of conjuring a comparative relational quality between highly heterogeneous entities through numerical reduction permeates the rationale and appeal of biodiversity offsetting in policy circles, as Julia Marton-Lefèvre; Director General of the Conservation agency IUCN recently expressed: "...business and conservation were two different camps counting different things, and now for the first time they are able to speak the same language"[7].

Stage 2. Connecting a monetary value to the numbers

The second layer of commensuration, this time through the function of price, embodies the moment that the commodification process is materialised. In theory, the financial costs of the offset are derived from the overall cost of providing habitat to the value of the units required, and is to be set by the offset provider (the seller). The exact pricing mechanisms for attaching monetary values to biodiversity units are unclear, and not explicitly articulated in any DEFRA documentation or guidance. One interviewee reported that DEFRA had tried to avoid the matter by simply recommending that developers and offset providers communicate directly to agree between them a price for securing compensation costs (LPA2.1). The price of an offset is therefore highly variable and context specific on wider market conditions such as land prices and is reputedly:

> "…the average between a calculated cost of purchase or rental of a 1 hectare piece of land, certain management and some capital works to that 1 hectare." (LPA1.1)

Furthermore DEFRA states that biodiversity offsets are to be delivered in perpetuity, such that they honour the ecological value and fundamental integrity of creating a habitat in one place that is compensation for the loss of another. The concept of 'in perpetuity' further complicates the mechanisms for establishing the financial costs and frustrates LPA officers tasked with devising them:

> "[…] oh and this whole in perpetuity thing just keeps kicking off. We calculated it [hectare of rare bird breeding territory] at £61,500 in 2007, I think, and land prices have changed massively since then. If you were to take that calculation and then try to calculate it for in perpetuity management it becomes something like £240,000 per hectare, it becomes totally unachievable. No development would pay for that, so what's the best compromise? We still haven't worked that out." (LPA1.1.)

[7] Opening address at the World Forum for Natural Capital, Edinburgh, November 2013.

The creation of a pricing mechanism that operates at a single moment in time but needs to reflect the on-going costs of maintenance over an undefined period without certain limits or fixed maturity date requires technologies such as discount rates and other financial constructs and assumptions. The LPA officer reports:

> "In perpetuity is the average life-time of a human being, which is seen to be 80 years in law, according to Natural England...And then the last thing I heard last week, is that you apply a discount rate. But that is based around a *human* relationship with stuff, not necessarily an ecological relationship with that stuff. So if you project those costs over an 80 year period, apparently it comes out the same as an annual fee for 27 years. So in effect if you were just paying an annual fee for maintenance, you'd only be securing it for a 27 year period." (LPA1.1)

With monetary value performing the fundamental mode of commensuration and exchange in market economics, it is the transmutation of ecological qualities into a format in which they are susceptible to financial value that finalises the second principal layer of value creation. We will now examine and illustrate, following a Marxian typology of commodification, the specific processes that are constitutive of the two higher stages of commensurability involved in the production of value in biodiversity offsetting beginning with abstraction.

Abstraction

The business of establishing biodiversity unit values involves conducting ecological surveys and assessments, the findings from which are subsequently re-codified according to uniform numerical inputs and rules. It is this very tampering with the 'nature of nature' that makes it commensurable with other distinct and qualitatively different types of nature, namely through the process of abstraction. Castree (2003), drawing on Robertson, distinguishes between two kinds of abstraction; functional and spatial. Functional abstraction is understood to be "where the qualitative specificity of any individualised thing is assimilated to the qualitative homogeneity of a broader type or process" (Castree 2003: 281). It follows, that the aggregation of sub-components during the process of standardisation inherent in the biodiversity metric and the production of 'units' through abstraction with a numerical proxy, are ones of potentially extreme simplification in the context of pronounced complexity and indeterminate uncertainty. As such, Sullivan (2012: 31) asks, whether these are subsequently also "profoundly un-ecological".

By way of example, a proposed development that was approved on the edge of SSSI woodland uses the locally adapted metric formulas to establish what value, in units, constitutes the site baseline, and will subsequently be lost through development and necessarily compensated for. The planning site in question comprises 0.8 ha of lowland heathland, which is a priority habitat of high distinctiveness (score; 6) but in poor condition (score; 1); meaning the calculation follows that 4.8 biodiversity units will be lost.

$$0.8 \times 6 \times 1 = 4.8$$

The offset habitat to be restored as compensation for the impacted site has a baseline value of 1.2 units calculated by 0.2 ha with a distinctiveness score of 6 and a 'poor' condition score of 1.

$$0.2 \times 6 \times 1 = 1.2$$

It is proposed that the value of the offset site can be doubled to 2.4 units by improving the condition of the lowland heathland from 1 to 2 units; conveyed qualitatively by improving its condition from 'poor' to 'moderate'. Thus, two questions emerge in respect to this small illustrative example. Firstly we may ask what is distinctively and materially different between a poor and moderate condition of lowland heathland?

The condition assessments in use are devised at the LPA level in accordance with Natural England, but lift from the Farm Environment Plan (FEP) Manual (2010) devised for the Higher Level Stewardship scheme. The condition assessments for lowland heathland are by and large characterised by coverage and frequency of shrubs and heather above a certain percentage threshold and undesirable shrubs and trees below a percentage threshold; but not graded bands according to specific percentages of coverage (FEP Manual 2010). The qualitative and quantitative preciseness in establishing the condition of a lowland heath according to three graduated bands of good, moderate and poor along uniform axes of heather coverage and shrub maturity shape the category outcomes in ways that send signals back along the ecological and financial value judgments of the calculation and yet seem to derive from a range of assessments that follow not insignificantly generalised and idiosyncratic guidelines. It follows, that the assessment outcomes might be unduly shaped and determined by their passageway into another logic, namely capital, in a process that Robertson, in characterizing such contradictions, proposes as aporetic (Robertson 2006: 379).

Our second question emerges in relation to moving numerical units of chopped up habitat to produce a quantitative net gain in overall biophysical indicators. For example, the heathland of this offset example is also ecologically proximate to and part of wider nightjar nesting habitat. Where the LPA officer overseeing this case suggests the heathland habitat offset will be relatively simple to obtain, they reported that finding nightjar compensation was "proving less easy"! (LPA1.1) The officer hopes "both can be accommodated by the same offset" illustrating that by design, they need not necessarily be so. Thus the functional abstraction produces value specifically from the "conceptual disaggregation of species from ecosystem fabrics and their re-embedding within calculative rationalities of quantification" (Sullivan 2012: 25). Standardisation of ecological qualities is necessary to make things comparable but of course has difficulties in so far as it hides categorically irrelevant divergences and complexities (Lamont 2003). This is a conflict one might reasonably expect in an area as complex, relational and indeterminate as ecosystems and wildlife habitats; where consensus on discrete, stable and coherent categories may be elusive. The very act of standardisation is necessary for the preparation of a market.

However, to achieve a feasible degree of substitutability between commodities thus facilitating a trade (Callon and Muniesa 2005) requires that goods be placed in a frame with other goods and a relational connection established between them, such that new types of classification and calculation can occur (*ibid.*).

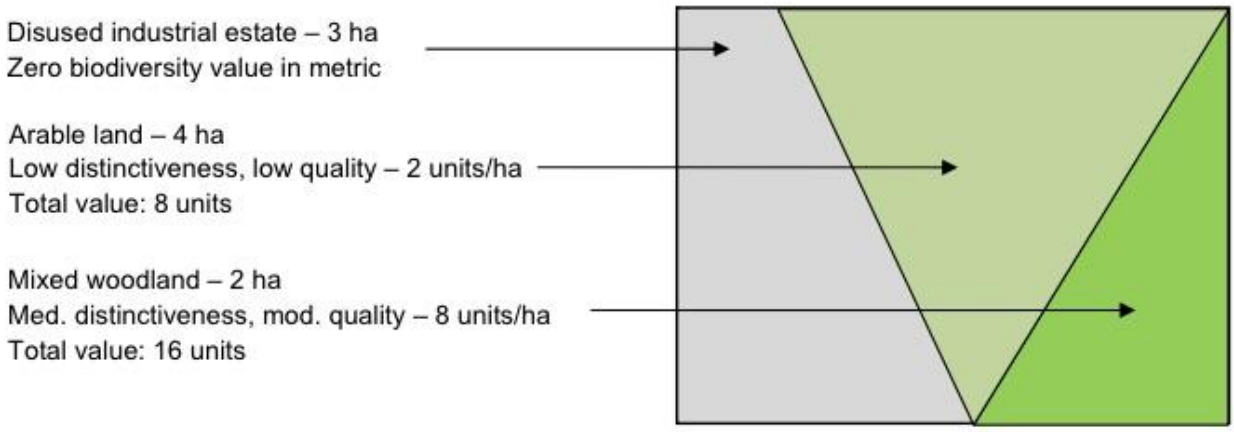
The second form of abstraction in the process of commensuration between different 'natures' is spatial, for which functional abstraction is a precondition (Castree 2003). Castree (*ibid.*: 281) writes that this involves "any individualized thing in one place being treated as *really the same* as an apparently similar thing located elsewhere." The construction of functionally abstract units of biodiversity means that the spatial specificity of one habitat or place can be substituted for another. An ecological consultant concerned with the implications of spatial abstraction articulates concerns over this scientific approach:

> "Between the site of ecological loss and gain, the geographical, edaphic and microclimatic factors alone of two separated sites mean the ecology would not be the same. And to suggest (as habitat banking implies) that you can offset a site in one place with another somewhere else (often a long way away) is just a demonstration that the basic science has not been understood – and the obfuscating metrics produced by offset proponents just serve to add a false patina to make it look like science" (PEC1.1)

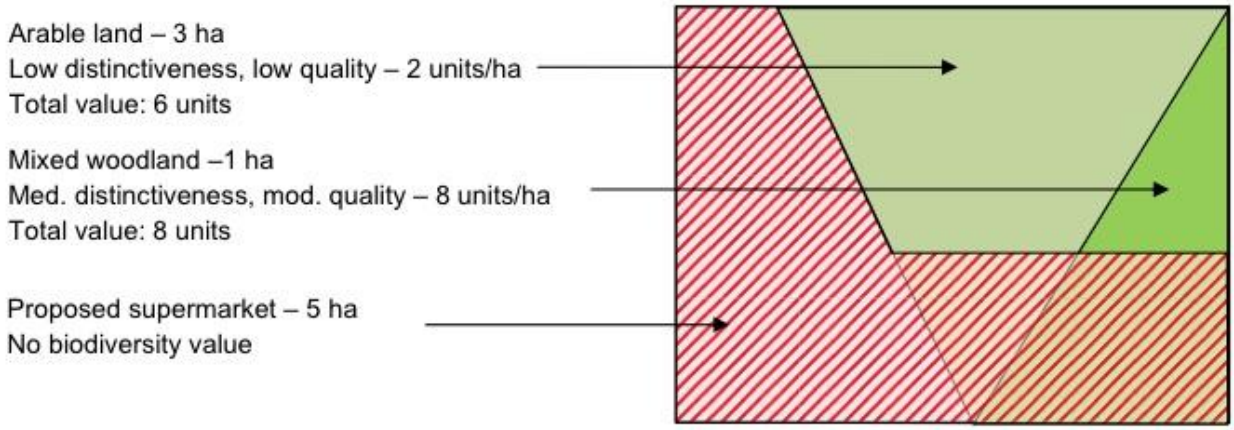
In addition to questioning the ecological integrity of imposing spatial abstraction onto ecosystems and habitats, there are also poignant social questions that emerge. Figure 3 is the example of a biodiversity offset that DEFRA provides in its 2013 Green Paper consultation, demonstrating how to compensate for the ecological impact and habitat loss of a new supermarket. As a communication tool it has simplified the step processes of biodiversity offsetting, yet in so doing encapsulates unambiguously what the calculations and models omit, or in other words, what the overflows are from the market's frame (Callon 2006). Overflows refer to what have been framed out of the value calculations, and therefore do not feature in the marketization or valuation process; at least until the calculative technologies have been further modified to 'internalise' or bring them in through corrective pricing and information flows (but in a process of ultimately perpetual incomplete accounting) (Lohmann 2009).

Figure 3. DEFRA 2013 Green Paper example of a biodiversity offset

A developer wants to build a supermarket on the 9 ha site below. Using the metric he quantifies the value of the site at 24 units.



The developer' application places the supermarket on the disused industrial estate but puts car parking and access road on the arable land and woodland as this closest to a main road. The developer's application sets out the impact in terms of units and shows the undeveloped part of the site would be worth 14 units. The developer therefore proposes to buy an offset worth 10 units (i.e. the loss in value of the site).



The planning authority is concerned about the amount of woodland that will be lost. Following discussion with the developer, the planning authority negotiates a revised design that would protect an additional 0.5 ha of woodland at the expense of losing a further 1 ha of arable land.

This increases the value of the remaining habitat to 16 units (14 units less 1 ha @ 2 units per ha plus 0.5 ha @ 8 units per ha). **Planning permission is granted on condition that the developer secures compensation equivalent to 8 units of biodiversity gain**.

Figure 3 illustrates the way that spatial abstraction facilitates the idea of compensating 8 units of biodiversity value in one place (or 4 hectares of arable land and mixed woodland) with 8 units of biodiversity value (of any size and type of habitat) elsewhere thereby resulting in 'no net loss'. What overflows from this technical frame, and what are visibly absent in DEFRA's diagram, are the proximate human lives, social use values, modes of attachment and senses of belonging to the *specific* 4 hectares of land in question, and the broader landscape fabric in

which they are woven. Equally, these may understandably be social attachments to *any* green space or place that is, ostensibly green and open and not in fact a car park. While the loss of one person's green space over someone else's has never been a material consideration in large scale planning decisions, it is not clear how the metrics designed in conjunction with biodiversity offsetting, as part of the new rhetoric around nature valuation, can honour the social and cultural value of living within close proximity to biodiverse habitats, increasingly recognised as fundamental to wellbeing[8]. Given that such wellbeing debates are utilised in support of the nature valuation paradigm, a contradiction emerges for biodiversity offsetting whereby the 'no net loss' agenda and broader catch all rhetoric for nature valuation sit in an uneasy partnership: the former conjures non-specific notions of abstracted biophysical nature and the latter appeals and alludes to, amongst other things the social, psychological and physical human wellbeing benefits of specific place based recreational green spaces and wildlife habitats. In so far as cost-benefit accounting rests on the commensuraton of spatially distinct natures it also tends towards 'commensurating winners' gains and losers' losses" (Alder and Posner 2001: 273) and as such, through rendering technical, is an example of 'anti-politics' (Murray Li 2007).

Individuation

Individuation refers to the "…representational and physical act of separating a specific thing or entity from its supporting context" (Castree 2003: 280). It follows, that the "material boundaries are demarcated", such that the thing can be bought, sold and exchanged, by "equally bounded groups or individuals" (*ibid.*: 280). Therefore, "it involves a discursive and practical 'cut' into the seamless complexity of the world in order to name discrete 'noun-chunks' of reality are deemed to be socially useful" (*ibid.*: 280). Within biodiversity offsetting, these are 'units' that conceptually alter ecologically expansive spaces into market friendly ones.

In considering the function of individuation to the creation of biodiversity value in biodiversity offsetting, an example may be drawn from the "discursive and practical cut" used to produce a single, distinct hectare of breeding territory for a geographically specific species of rare bird[9] derived from a pilot study interview data. This species of bird was once a common farmland bird almost lost to the UK in the 20th century but now almost entirely restricted to parts of southern England, due largely to habitat loss and agricultural intensification. In order to compensate for the loss of their habitat through development using the offset mechanism, planners must first isolate one hectare of breeding territory so that the 'abstracted value' of the loss can be quantified, monitored and rendered equivalent to other one-hectare units of compensation to be provided. In interview a local planning officer notes:

> "There are question marks as to what the trigger is for that one hectare. A breeding territory is a 250m radius from a singing male, who will generally be singing fairly near or within a 250m radius of his nest. The problem is that when you record him, he may be on the 250m mark away from his nest. We then

[8] The Wildlife Trusts and RSPB in October 2014 together released "The Nature and Wellbeing Act" making the case for the Government to introduce a Nature and Wellbeing Act for England to reverse the decline of the natural environment for the benefit of promoting health, social and psychological wellbeing http://www.rspb.org.uk/Images/nature_and_wellbeing_act_green_full_tcm9-384572.pdf accessed January 30th 2015.
[9] The species name has been omitted to protect interviewed subjects anonymity.

> put a theoretical 250m buffer zone around this singing male and say *that* is his breeding territory. A 250m radius creates, I think it's about a 19 or 21 hectare area, so if you lose 5% of that area that equates to about 1 hectare." (LPA1.1)

Similarly, where commons land under the 16th Century Enclosure Act saw the transformation of landscapes that were sliced, diced and delimited according to the property rights of new landowners, today, owners of land that has been certified as an offset receptor site or habitat bank will be able to divide this up along the new economic and legal boundaries of individual offsets. The administrative boundaries of these units define newly productive landscapes generating value by providing a specific number of conservation credits through the individuated ecosystem services they provide to a range of geographically divergent developments and entitled 'buyers'. In writing about the wetland-banking sector in the United States, Robertson (2006) suggests that ecological information undergoes a translation that makes it legally and economically coherent. Yet, in creating stable, discrete conceptual categories intelligible to administrative procedures and amenable to titled buyers and sellers, the information is thus rendered *ecologically* incoherent (*ibid.)*. Knowledge about nature, therefore, must be managed and transformed, so that it is translatable into the logics of capital.

Discussion

This paper has discussed some of the shortcomings and assumptions implicit in the practice of erasing the demarcations between the ecological and the economic. In so doing the former is rendered mobile and fluid and becomes newly materialised as exchange value. This critical capitalist shift in the logics of conservation has been articulated elsewhere as "nature on the move": a value that is no longer static but mobile, reflecting the classical Marxian concept of "value as process" (Büscher 2014: 21 citing Marx 1976: 256). Exchange value is created with each layer of imposed commensuration within the steps of an offset calculation and constitutes a fundamental and ontological transformation to the primary 'nature' that is affected, constructing credit and debt value that circulates on the registers and inventories of institutional offset practitioners and local authorities. Thus when DEFRA defend biodiversity offsetting as something other than the monetisation of nature, it is making a true statement, but for the wrong reason. Biodiversity offsetting is not the monetisation of nature, but instead, the monetisation of its numerical abstractions by way of units- not the material habitats they signify – be they rare bird breeding sites, woodland or wetlands. The disjuncture between these material habitats and the financial sums to which they are connected supports DEFRA's defence. However, the difference between the material and its abstraction also alludes to the difficulties and fallacies in proposing that biodiversity offsetting and the metric calculations are unproblematic and robust guardians or meaningful signifiers of nature's networked materiality and value, which is intrinsically and inalienably polyvalent. One may reasonably ask- what must be omitted from these value calculations for them to function according to the designs? Thus we can see how biodiversity's material intransigence means it defies monetary valuation in the neat, objective way that the elegant, if simplistic logic of biodiversity offsetting proposes; a

policy tool that must walk a tightrope between accessible simplicity and sophisticated nuance. There are of course merits to moving beyond debating solely the technical aspects of what an ideal biodiversity metric looks like and the wider governance and policy processes in which it is embedded. However, none would escape this elision entirely.

There are *a priori* broad questions about the political and ideological significance of extending market-based approaches to address the urgent problem of biodiversity loss and land use change in general. This paper has moved beyond this primary critique of whether and under what circumstances it is appropriate to commodify nature for the greater good or to achieve specific utilitarian ends, and has raised questions over the technical possibility of pursuing this route, whatever the answer to the ethical and ontological problematics might be. Further research will seek to understand, through a critical political ecological lens, the likelihood of such valuation practices achieving such stated desired ends: that is, protecting and restoring a resilient and connected ecological network of biodiverse habitats across the country.

For example, in considering the imaginative possibilities of valuing nature with unit scores and economic proxies we may ask whether the processes associated with rendering biodiversity exchangeable and commensurable might in fact elude any possibility of a full conceptualisation of those biotic entities, relationships and places, whereby their disclosure by economic valuation may leave them more marginalised in social decision making than before (Yusoff 2011: 4)? How might we ameliorate the difficulties of articulating appropriate ways to value flourishing biodiversity and ecological functions as both systems integral to human wellbeing and instrinsic, specific ends in their own right (Latour 2005)? Indeed there are opportunities for offsetting; due to the nature and scale of building and development proposed in England. The act of introducing new metrics to account for what is present, kept, and lost at a development site means that much of what habitat was previously disregarded as insignificant in terms of ecological value, will become materialised as numerical inputs to calculations and therefore gain visibility and traction when before it had none.

The current situation of biodiversity in England is one of a negative trend of attrition, or 'death by a thousand cuts' from land use change and habitat loss whereby lots of smaller pieces of brownfield and indeed greenfield land are given over to development, under the presumption that they are marginal, despite them providing habitat and ecological connectivity. In contrast, it is hoped that a new system of biodiversity offsetting will put an end to this negative spiral of biodiversity loss through providing compensation for what is lost in development. In the spirit of 'pragmatism', conservation biologists and policy makers are understandably searching for solutions that are compatible with preponderant economic and political priorities (Sandbrook, Fisher and Vira 2013) and oriented towards rationalistic cost-benefit analyses along an economic continuum. But there are questions over what sorts of ideological, conceptual, imaginative work these shifts are performing, and for whom, in particular, this will be 'of value'. As such it is hoped that when considering the methodological challenges of valuation as an act, and the complexities of environmental valuation as a governance paradigm, we can remain attentive to the broader structuring logics and political

realities of the valuation context, lest such efforts fall foul of fulfilling the "tragedy of the *well intentioned* valuation" (Gómez-Baggethun and Ruiz-Perez, 2011).

In calling for greater awareness of the socio-political context of valuation and its desired political goals, Kallis, Gómez-Baggethun and Zografos, (2011) elucidate the pitfalls of well-meaning albeit politically naïve approaches towards the valuation of nature that may all too frequently confirm and reinforce the conditions of ecological decline through acting in primary service to the higher neo-liberalised political orders of worth for economic growth and efficiencies. Both the DEFRA Natural Environment White Paper and Natural England's Corporate Plan 2014-2019 illuminate the political conditions for environmental governance in England at the present time as one in service to, and providing support for, 'sustainable development' and the growth of the UK economy. This guidance is reflected in the everyday working culture of Natural England as a senior ecologist articulates "At the moment there is a big emphasis on growth and as an organization we have a responsibility to look for solutions ensuring the environment is not in conflict with development" (NE6.1).

Conclusion

Biodiversity offsetting policy in England and its valuation practices do not derive from a linear institutional process, but instead are being realised, tested, contested and iterated via a range of "complex cognitive, analytical, discursive, political, institutional and material devices" which are co-acting to reshape conservation norms and practices (Kallis, Gómez-Baggethun and Zografos, 2013). The discursive frames, institutional and material tools have been deconstructed here as a way of exploring the assemblage of parts that perform such value making and valuation practices. The objective has been to assist us, as ethnographic observers, to understand the emergence and treatment of value in the nascent field of biodiversity markets in England. In turn, understanding biodiversity offsetting *in situ* will illuminate moments where interventions in any of the three nodes of the assemblage could improve such valuation practices and prevent a tragedy of the well-intentioned valuation.

This paper has demonstrated the discursive and materially transformative effects of new value technologies and systems on biodiversity and wildlife habitats in England. It has explored what it actually means to 'value' nature and biodiversity, and argued that valuation performs a manufactured commensuration *vis a vis* the biodiversity metric. This calculative entity performs and conforms with certain renderings of value, in line with, and in service to, broader political-economic priorities for growth and development. It does not easily correspond to the actual material reality of nature in situ, or represent an accurate commensurability with it, and nor could it. The question remains whether such renderings of value are able to honour the expectations of those involved, or at least the avowed good intent of the proponents of the approach, to deliver a renewed and invigorated set of social-environmental relations. After all, the biodiversity offsetting discourse, experienced by some as a nascent, optimistic and transformative valuation process, is avowedly in service to this greater effort. Or whether the

symbolic violence of the matrix is a further neoliberalising act which renders Nature even more disposable and alienable than before such 'valuation'.

Acknowledgements

This paper has benefited from the direction and recommendations of Sian Sullivan, my academic supervisor and Chris Sandbrook, who acted as supervisor to my PhD upgrade exam. Sarah Bracking provided editorial guidance. Any mistakes of course remain wholly my own.

References

Alder, M D and Posner EA (2001) Implementing cost–benefit analysis when preferences are distorted 269–311. In: M. D. Adler & E. A. Posner (eds), *Cost–benefit analysis: Legal economic and philosophical perspectives*. Chicago: University of Chicago Press.

Anderson B and MacFarlane C (2011) Assemblage and Geography *Area* 43(2): 124-127

Bracking S, Bond P, and Brockington D, et al (2014) Initial Research Design: Human, non-human and environmental value systems: an impossible frontier? Leverhulme Centre for the Study of Value Working Paper Series No. 1, Manchester.

Büscher B, Sullivan S, Neves K, Igoe J, and Brockington D. (2012) Towards a consolidated critique of neoliberal conservation *Capitalism, Nature, Socialism* 23(2) 4-30.

Brockington D and Duffy R (2010) Capitalism and Conservation: The Production and Reproduction of Biodiversity Conservation *Antipode* 42 (3), 469-484.

Castree N and Henderson G (2014) The Capitalist Mode of Conservation, Neoliberalism and the Ecology of Value. *New Proposals: Journal of Marxism and Interdisciplinary Inquiry* .7(1): 16-37.

Çalişkan K and Callon M (2009) Economization, part 1: shifting attention from the economy towards processes of economization *Economy and Society* 38(3): 369-398.

Çalışkan K and Callon M (2010) Economization, part 2: a research programme for the study of markets *Economy and Society*, 39 (1): 1-32.

Callon M and Muniesa F (2005) Economic Markets as Calculative Collective Devices. *Organisation Studies* 26 (8): 1229-1250.

Callon M (2007) What Does it mean to Say Economics is Performative? In: MacKensie D, Muniesa F and Siu L (eds) *Do Economists Make Markets? On the Performativity of Economics*: Princeton University Press.

Castree N (2003) Commodifying what nature? *Progress in Human Geography* 27 (3) 273-297.

Costanza, R., et al (1997) "The value of the world's ecosystem" *Nature* 387: 253–60.

Department for Communities and Local Government (DCLG) (2012) National Planning Policy Framework (NPPF).

Department for Environment, Food and Rural Affairs (DEFRA) (2011a) The Natural Choice: securing the value of nature.

Department for Environment, Food and Rural Affairs (DEFRA) (2011b) Biodiversity offsetting; Guiding Principals.

Department for Environment, Food and Rural Affairs (DEFRA) (2012) Biodiversity Offsetting Pilots. Technical Paper: the metric for the biodiversity offsetting pilot in England.

Department for Environment, Food and Rural Affairs (DEFRA) (2013) Biodiversity offsetting in England. Green Paper.

Fourcade M (2011) Cents and Sensibility: Economic Valuation and the Nature of 'Nature'. *American Journal of Sociology* 116 (6): 1721-77.

Gómez-Baggethun E and Ruiz Pérez M (2011) Economic valuation and the commodification of ecosystem services. *Progress in Physical Geography* 35 (5): 613-628.

Igoe J (2010) The spectacle of nature in the global economy of appearances: anthropological engagements with the spectacular mediations of transnational biodiversity conservation. *Critique of Anthropology* 30(4): 375- 397.

Igoe J and Brockington D (2007) Neoliberal conservation: A brief introduction. *Conservation and Society* 5(4): 432- 449.

Hill, D. (2011) Environmental Markets for Ecosystem Services in the UK: scope, opportunity and challenge. The Environment Bank, UK. http://www.environmentbank.com/files/pesenvironmentalmarketsforbes.pdf (accessed 6th October 2014)

Helgesson F and Muniesa F (2013) For What It's Worth: An Introduction to Valuation Studies. *Valuation Studies* 1 (1): 1-10

House of Commons Environmental Audit Committee (2013) Biodiversity Offsetting. Sixth Report of Session 2013-2014. London

Kallis G, Gómez-Baggethun E and Zografos C (2013) To value or not to value? That is not the question. *Ecological Economics* 94: 97- 105

Lawton J. et al. (2010) Making Space for Nature: A review of England's Wildlife Sites and Ecological Network. Consultation presented to Department for Environment, Food and Rural Affairs

Lamont M (2012) Toward a Comparative Sociology of Value and Evaluation. *Annual Review of Sociology* 38**:** 201-221.

Lohmann L (2009) Toward a different debate in environmental accounting: The cases of carbon and cost-benefit. *Accounting, Organizations and Society* 34: 499- 534.

Hannis, M and Sullivan S (2011) Offsetting Nature? Habitat Banking and Biodiversity Offsets in the English

Land Use Planning System. Green House: Weymouth, Dorset.

MacAfee K (1999) Selling nature to save it? Biodiversity and green developmentalism. *Society and Space* 17 (2): 203-219.

MacDonald K (2010) The devil is in the (bio)diversity: Private sector "engagement" and the restructuring of biodiversity conservation. *Antipode* 42 (3): 513-550.

MacDonald K and Corson C (2012) 'TEEB Begins Now': A Virtual Moment in the Production of Natural Capital. *Development and Change* 43 **(**1): 159-184.

Mackensie D and Millo Y (2003) Constructing a Market, Performing a Theory: The Historical Sociology of a Financial Derivatives Exchange. *American Journal of Sociology* 109 (1): 107- 145.

Mackensie D (2006) *An Engine, Not a Camera: How Financial Models Shape Markets.* Cambridge, MA: MIT Press

Mitchell T (2008) Rethinking economy. *Geoforum* 39: 1116- 1121.

Murray Li T (2007) Practices of assemblage in community forest management. *Economy and Society* 36 (2): 263-293

Natural England Corporate Plan 2014-2019. Natural England 2014.

Natural England Higher Level Stewardship. Farm Environment Plan (FEP) Manual. Technical guidance on the completion of the FEP and identification, condition assessment and recording of HLS FEP features Third Edition, March 2010

Robertson M (2006) Nature that capital can see: science, state and market in the commodification of ecosystem services. *Environment and Planning D: Society and Space* 24: 367- 387.

Robertson, M. & Hayden, N. (2008) "Evaluation of a market in wetland credits: entrepreneurial wetland banking in Chicago." *Conservation Biology* 22(3): 636–646.

RSPB (2013) The State of Nature. Royal Society for the Protection of Birds.

Sandbrook CG, Fisher JA and Vira B (2013) What do conservationists think about markets? *Geoforum* 50: 232-240.

Sullivan S (2010) 'Ecosystem Service Commodities' - A New Imperial Ecology? Implications for Animist Immanent Ecologies, with Deleuze and Guattari. *New Formations* 69 (18): 111-128.

Sullivan S (2012) Financialisation, Biodiversity, Equity: Some Currents and Concerns *Environment and Development Series* **(**16) Third World Network: Malaysia.

Sullivan S and Hannis M (2014) Nets and Frames, losses and gains. Value struggles in engagements with biodiversity offsetting in England. Leverhulme Centre for the Study of Value Working Paper Series No. 5, Manchester.

Treweek, J, ten Kate K, Butcher B, Venn O, Garland L, Wells M, Moran D and Thompson S (2009) "Scoping study for the design and use of biodiversity offsets in an English Context. Final report to DEFRA (Contract NE 0801)

Treweek, J, Butcher B., and Temple H (2010) Biodiversity Offsets: possible methods for measuring biodiversity losses and gains for use in the UK. *In Practice* 69: 29–32.

ten Kate K, Bishop J and Bayon R. (2004) Biodiversity Offsets: Views, Experience, and the Business Case. IUCN, Gland, Switzerland. And Cambridge, UK and Insight Investment, London, UK.

Yusoff K (2011) The valuation of nature. *The Natural Choice* White Paper. Commentry. *Radical Philosophy* 170:1-6

TEEB (2011) The Economics of Ecosystems and Biodiversity in National and International Policy Making. Edited by ten Brink P. Earthscan, London and Washington

Tsing, A (2000) Inside the Economy of Appearances *Public Culture* 12 (1): 155-144.

Roth RJ and Dressler W (2012) Market-oriented conservation governance: the particularities of place. *Geoforum* 43 (3), 363–366.